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SERVICES for the CHILD WHO IS HARD of HEARING

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a guide for the development of programs

SERVICES for the CHILD WHO IS HARD of HEARING

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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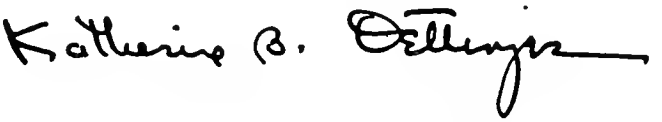
contents

When this publication was first issued in 1950, hearing conservation programs were already established in a number of States and in many localities. Some principles about program development had been clearly established and others were being considered. As programs have developed, new groups of professional and nonprofessional persons have become involved in them. New issues have arisen, and some old ones have continued to be discussed. By 1961, nearly all the States had developed hearing conservation programs in their maternal and child health and crippled children's services which, in a variety of ways, provided for the testing and followup services for children with hearing impairments.

This publication has been rewritten to discuss concepts and principles pertinent to the establishment and further development of State and local hearing conservation programs. Those aspects of community planning which are specifically concerned with the problems of adults, vocational guidance and industrial noise, are not given special attention.



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SERVICES for the CHILD WHO IS HARD of HEARING

HEARING CONSERVATION

Goals

A child whose hearing is impaired may be seriously handicapped, not only in the development of communication skills, but also his mental, emotional, and social development may be delayed and distorted. A total program of casefinding, diagnosis, treatment, prevention of hearing loss and other services for persons with hearing handicaps is called "hearing conservation." The term has several connotations, depending upon who uses it. In the armed forces and in industry, hearing conservation programs are particularly concerned with preventing and reducing the effect of high level noise.[1] In schools, the term refers to special educational programs to make use of residual hearing in learning.[2] In medicine and public health departments and crippled children's agencies, the primary concern is the prevention and the medical and audiological treatment of hearing impairment.[3] Hearing conservation, from the standpoint of maternal and child health programs and crippled children's programs, has the following meaning, or goals:

1. The prevention of conditions leading to hearing impairment, including prenatal conditions and environmental influences.
2. The early identification of hearing impairments or conditions which lead to such impairments.
3. The early multidisciplinary evaluation and diagnosis of the hearing impairment.
4. The provision of effective medical and surgical care.
5. The provision of effective audiological services, including hearing

aids, speech reading, auditory training, speech training and counseling.

6. The improvement and extension of community health education with respect to hearing impairment.

Prevalence

Hearing testing surveys for the purpose of establishing that hearing impairments are a serious public health problem are no longer necessary. There is substantial evidence that 4 to 5 percent of the school age children will fail to "pass" a screening test and thus need further examination. Of these, about 2 percent will need to be referred to physicians for hearing impairments requiring medical attention.

The variations which exist in the prevalence data can be attributed to such factors as different testing methods, different pass-fail criteria, the effect of environmental noise, and the calibration of the testing equipment.

There have been few prevalence studies of hearing impairment among infants and preschool age children. These studies, despite the variation in reporting prevalence (from 1.2 percent to 21 percent) do point up the need for early detection of the hearing impairment.[4 5 6 7 8] Because methods of testing hearing for the infant and early preschool age are less reliable and take more time, mass screening surveys for casefinding purposes have not yet become widespread.

Classification of hearing impairments

The terms "hard of hearing" and "deaf" frequently are used to refer to different degrees of hearing handicap. Although there are similarities between the two conditions, there are, also, important differences. A comprehensive evaluation and diagnosis of the child's communicative behavior is needed before either of the terms can be used appropriately.

A child who is deaf is one who cannot communicate solely by means of his auditory ability. He must depend upon other sensory avenues. If he has not developed oral communication skills prior to the onset of his deafness, he will not be able to produce or understand oral language normally. Socially and educationally, he is severely handicapped.[9]

A child who is hard of hearing is one who, despite his hearing impairment, makes use of hearing in acquiring the major part of his speech and education.[10] Such descriptive classifications as "deaf" and "hard of hearing" are important in the development of educational and habilitative services.

Hearing impairments are frequently classified on the basis of a measurement of the loudness required to overcome a loss in sensitivity for speech. Two similar classifications are:

−10 db to 15 db	Normal hearing.
16 db to 81 db	Hard of hearing.
82 db or more	Deaf.

—*Hearing and Deafness*, Davis, Silverman [11]

20 db to 40 db	Mild hearing loss.
40 db to 60 db	Moderate.
60 db to 75 db	Severe.
75 db to 100 db	Profound.

—*Audiology*, Newby [12]

Classification may be based upon the results of pure tone audiometry. For instance, evaluation for medico-legal purposes weighs the loss in specified frequencies in order to determine the extent of the handicap in terms of an overall percentage of hearing loss.

Because health oriented services seek to prevent, find, ameliorate, and modify the effect of hearing impairment, other classifications may be more pertinent. A classification system based on the site of the impairment focuses attention on its pathology and etiology. Terminology on this basis distinguishes between impairments: (1) which affect the transmission of mechanical sound vibration through the hearing mechanism (conductive), (2) which affect the transmission of neural stimuli (sensorineural), and (3) which affect the final understanding of the auditory signals (dysacusis).

Conductive hearing impairment, or conductive hypoacusis refers to the loss of sensitivity when sound is not transmitted freely through the external and middle ear to the sense organ in the inner ear.

Sensorineural hearing impairment, or sensorineural hypoacusis refers to a loss of hearing sensitivity due to impairment of the sense organ and/or the auditory nerve pathway. The loss may be greater

for some frequencies with the result that not only is the intensity of the auditory signal diminished but the information it conveys may be so distorted as to affect its intelligibility. The term perceptive impairment is sometimes used, not very precisely, in referring to this kind of an impairment.

Dysacusis refers to an impairment in the use of verbal symbolic language presumed to be due to a dysfunction in the central auditory pathways or the auditory cortex itself.

Various combinations of hearing impairment may result from multiple conditions involving the different physiological and psychological aspects of hearing included in the previous descriptions.

TYPES OF TESTS

At the casefinding stage of hearing conservation, only a limited number of tests are of concern. At the diagnostic stage, more complex tests are required which are the responsibility of the medical and audiological professions. Discussion of these tests is not within the scope of this guide.

Nonaudiometric

Some tests cannot be used to ***measure*** hearing, but can serve to identify children who need further evaluation. These tests necessitate the careful observation and evaluation of the child's responses to auditory stimuli. For infants, these tests are more than tests of "hearing." The kind of response a child makes differs as he grows thus his responses to auditory stimuli give some indication of the level of his neurological development.

Effective screening testing of the infant and very young child requires that the sound be presented without any visible clues as to its source, and at a level of loudness which is easily heard, but not startlingly loud. The different frequency ranges, high, mid and low, should be tested. Careful and knowledgeable observation of the child's response should be made to determine whether the response was actually elicited by the auditory signal and to note the exact nature of the response.[13]

For the infant, 2–3 months of age, hearing is a reflex reaction to sound stimuli. His eyeblink, or kick, or gross body reflex suggests only that the aural mechanism is intact for the conduction of sound. The responses at this age appear to be too variable to standardize the test for a mass screening survey. Evaluation of such responses should be, of course, an integral part of a pediatric examination. Fairly reliable screening tests can be conducted when the child is 8 to 9 months old.[14] At this age, the child, presumably, has learned to listen and can be expected to turn his head toward the sound source. Infant testing techniques are presented in the film "Auditory Screening for Infants." *

*Available from the Bureau of Preventive Medicine, Maryland State Department of Health, Baltimore 1, Md.

The procedure is basically a modification of the familiar Ewing's test.[15] An observer attracts the child's attention visually at which time the examiner makes a specified acoustic signal such as a rattle, rustle, tone, or speech to which the infant might respond. Different noises presumably emphasize different frequencies as well as eliciting a learned reaction to a known sound. The intensity of the stimuli is a critical element in the test. Failure to elicit a response does not necessarily indicate that the infant has a hearing impairment, but does indicate that further examinations are warranted.

For testing the preschool child, standard pure tone audiometry has been used successfully with the 4-year-old. For younger children various modifications to gain rapport and motivate a response can be used. This so-called "play audiometry" attempts to condition the child's responses. Such testing is essentially clinical testing rather than screening.

The use of tape recorded tests is being increasingly explored as a means of mass screening. This kind of speech audiometry consists of words and/or familiar sounds presented through earphones at the same time that the child selects from a choice of visual representations. One example of the tape recorded test developed by the Hearing and Speech Clinic at the Mayo Clinic uses the carrier phrase, "Show me the . . ." and "Where is the . . ." A series of two syllable words (spondees) such as sandbox, sailboat, airplane, follows. The loudness of the words drops successively by 4 db to a 15 db level in the earphones.

A different kind of tape recorded test is the familiar sounds test developed by the Hearing and Speech Center at the University of Denver. Such sounds as an auto horn, a gunshot, a bird song, a cat meow and a telephone bell are recorded in such a way that only specified bands of frequencies are used thus attempting to test the child's responses to high, mid and low frequencies.

Tape recorded tests may eventually prove to be the optimal method for mass screening surveys of the very young. Presently, there are enough questions about the reliability and the validity of the tests that no firm recommendation is warranted. Exploration of this technique in programs of child health supervision should be continued.

Tuning fork

The tuning fork, properly used, provides valuable information about the relationships between hearing by air and by bone conduction. The interpretation of the results is essentially a diagnostic evaluation. It has not been used in mass screening programs for its use depends upon the skill of the examiner. Even then, the tuning

fork is not completely reliable. (Audiometers equipped with bone conduction units can be used to conduct some of the tests of the relationships of air and bone conduction.)

Audiometric

Audiometry is the process of measuring hearing levels with an electroacoustic instrument, the audiometer. It produces audible tones which can be calibrated and controlled in both frequency and intensity. Types of audiometers are discussed on page 8. An audiometric test is ***precise*** in that the listener may repeat his responses consistently, but it is not ***accurate*** in the sense that it truly identifies ear pathology or abnormality.

Identification audiometry refers to the screening tests for case-finding purposes. The purpose of identification audiometry is to find those who fail to respond appropriately and, therefore, should be evaluated further. Identification audiometry differs from diagnostic audiometry. The latter is conducted under controlled clinical conditions and includes special tests and more complex procedures.

Screening tests are usually pure tone, air conduction tests in which the tones are presented at intensities exceeding the average normal threshold. The listener responds in a yes or no manner as to whether he hears the tones. Screening tests do not determine the ***threshold of hearing.*** (***Thresholds of hearing*** are the least intensities that can be heard at the selected frequencies.) In hearing testing programs, persons who fail to hear at the screening stage are referred for threshold tests. These threshold values are one criteria for deciding upon referral to a physician. Also threshold levels are useful in establishing a ***reference audiogram*** for comparison with later audiograms and, of course, threshold levels are indispensable in diagnosing a hearing impairment. When speech is the signal used rather than a pure tone, the weakest intensity at which it can be understood is called the speech reception threshold (SRT). The SRT is a measurement which contributes greatly to the clinical diagnosis.

Audiometric tests for screening, either pure tone or speech, may be conducted individually or with groups of listeners. It is a moot question whether the total time involved is less for the group testing. While more children can be screened initially with group equipment, more will have to be retested later. Group screening has a disadvantage in that it does not allow the examiner to observe each listener individually. It is not necessary for a program to be limited solely to one type of testing.

AUDIOMETERS

Types

Pure tone audiometers can be classified on the basis of the range of frequencies as wide range, limited range, or narrow range. Different ranges of intensity are provided.[16] See Table I.

Table I. CLASSIFICATION OF AUDIOMETERS

Type	Available frequencies	Intensity
Wide range.....	125, 250, 500, 1000, 2000, 4000, 8000 (1500, 3000, 6000).	—10 db to 95 db.
Limited range...	500, 1000, 2000, 3000, 4000, 6000.	0–65 db.
Narrow range...	2000 and 4000 or 4000.	One to three levels.

The *speech audiometer* presents spoken material which may have been prerecorded, or which may be "live."

The *automatic audiometer* is one in which the auditory signal is controlled by the listener. The listener's responses are recorded automatically.

The *group audiometer* uses multiple earphones. It can be either a pure tone or speech test. Responses of listeners can be recorded in a number of different ways.[17]

Standards for audiometers

Only audiometers which meet the specifications of the American Standards Association should be considered for purchase.[18] However,

the fact that an audiometer is stated to meet these standards does not assure continuing electronic stability or trouble-free operation. A hearing conservation program, therefore, should include plans for the regular recalibration and upkeep of the audiometer. The procedures and the expense involved in recalibration for a specific audiometer should be considered when purchasing it.

Although recalibration requires technically trained persons using special equipment, frequent checks on the operation of the audiometer should be a part of the regular procedure. This kind of verification of the calibration can be conducted by testing as a control a person whose hearing is normal.

Audiometric data

Customarily, the results of pure tone audiometry are recorded on an audiogram (Appendix B, table 1). Frequently, the data is recorded in the form of a tabulation rather than a graph, thus conserving record space. Audiometric data can be stored on data processing cards for the rapid study and evaluation of a large number of records. Examples of hearing conservation reports can be seen in Appendix B.

The intensity levels are read from the "hearing loss" dial in decibels. The zero level on the audiometer represents an average based on a study of the hearing of adults. The Pittsburgh Study of Hearing of Children has substantiated that children hear better than the zero level marked on the audiometers.[19] The interpretation of audiometric data, both in screening and in clinical testing, must take into account that the present "audiometric zero" is not the real "threshold of hearing" for children.

BASIC DECISIONS

The extent of the casefinding activities should be influenced by the availability of followup diagnostic and treatment services. The decision should be made in the context of a total public health program in which screening activities for many different health conditions can complement and augment the hearing program. A comprehensive hearing conservation program requires decisions on the following: (1) the age range of the children to be tested; (2) the kinds of screening tests to be used; (3) the intensity and the frequencies to be used in the screening tests; (4) the intensity and the frequencies to be used for the threshold tests; (5) the kind of evaluations to be made prior to referral to a physician; (6) selection of the testing equipment; (7) selection of the records to be kept; (8) selection and training of personnel; and (9) how medical examination and treatment services will be provided.

Selection of age range

Presently, few programs are testing the preschool and infant age groups yet it is self-evident that for maximum values of prevention and early treatment, the hearing impairment should be discovered earlier than the school age at which most testing programs begin.

Casefinding for hearing impairments among infants and preschoolers can be a part of good maternal and child health supervision. Children who may have hearing impairments caused by adverse prenatal and birth conditions should be a special concern of the program.

Hearing testing programs for infants and preschool children can be developed in cooperation with church groups, day care and nursery centers, and in the well baby conference and crippled children's clinics. In each community there are other possibilities of planning a testing program to handle numbers of children.

Early testing of hearing should, of course, be part of the child's regular examination by his physician.

For school hearing testing programs, the recommendation of the Conference on Identification Audiometry is for "annual testing in kindergarten and grades 1, 2, 3. . . . More important than to sched-

ule hearing testing in certain grades every year is to insure that no child fails to have his hearing tested at least every 2 or 3 years." [20] This recommendation attempts to be realistic about the costs of testing all of the children every year. Many State testing programs start with grade 1 and test the alternate years of 3, 5, 7. Some begin with grade 2 presumably on the basis that there are too many children in the first grade who have hearing problems which disappear—a doubtful presumption. In addition to the regularly scheduled groups, children in the following special categories should be tested: children who have had serious illnesses, who have behavioral problems, who are having learning difficulties or speech problems, and who are new to the school. Children with known hearing impairment should be more thoroughly tested for the purposes of reevaluating their hearing performance. Obviously, there is no point in testing those with known impairments at a screening level of intensity.

Selecting the test

Pure tone air conduction audiometry on an individual basis is the most common testing procedure. A few State programs use pure tone audiometry on a group basis. The choice between individual and group procedures should not be made solely on the basis of the testing time that might be saved. Both tests are adequate for screening purposes, but group audiometry requires more equipment, more maintenance, a larger testing space, and a testing environment freer from auditory and visual distraction. Moreover, one of the important factors in a screening test is that it should be kept as simple as possible. Group audiometry presents additional, but not insurmountable, problems in training personnel, maintaining the multiple headsets, and checking the equipment for proper operation.

Selecting the testing criteria and procedures

The initial audiometric screening is frequently called the sweep check test. The operator "sweeps" through the selected frequencies at a pre-set intensity to which the listener responds whether he hears the tone with a *yes* or *no* response. No attempt is made to determine the exact nature of the listener's hearing threshold. Those who fail to hear the screening test are scheduled for threshold testing and further attention.

This guide is not intended to be an operator's manual, therefore, detailed testing procedures are not presented. Although such procedures are simple and fairly easy to learn, operators should be trained under the supervision of a specialist competent in hearing

testing. Some State health departments have procedural manuals available on request.

Frequencies for screening

For screening purposes, the following frequencies are recommended: 500, 1000, 2000, 4000, and 6000 cps.[21] This recommendation of the Conference on Identification Audiometry is based on a compromise of such factors as (1) the contribution of specific frequencies to increasing the sensitivity and accuracy of the screening test, (2) the significance of the added information and (3) the costs saved in using fewer frequencies.

Controversy exists as to the use of *narrow range* frequency testing which utilizes only 2000 cps and 4000 cps, or only 4000 cps. At present, neither research evidence nor field experience show incontrovertibly that such narrow range frequency testing is preferable to the limited range recommended in the previous paragraph.

Intensity criteria for screening

Despite the fact that almost every State has been using 15 db as the testing criteria, the Conference on Identification Audiometry recommended the use of 10 db.[22] The recommendation *assumes a reasonably quiet environment* to reduce the masking effect of ambient noise.

Both the 15 db, widely used presently, and the recommended 10 db have been selected arbitrarily. At the 15 db level of loss, the listener may begin to experience some disability; at the 20 db level of loss, he may be slightly handicapped for communication purposes. In view of the data from the Pittsburgh Study which shows that normal hearing for children is acute to below audiometric zero, the recommendation of 10 db as a screening criteria should be seriously considered. An unusually high over-referral rate which might occur when using 10 db should be carefully investigated to determine all the contributing factors before the screening intensity is increased. A basic principle is that the intensity must be weak enough to identify those children who are not yet handicapped, or whose hearing problem could not be otherwise identified by parent or teacher observation.

Selecting the referral criteria

Once the initial screening is completed, an additional test "rechecking" those who fail the first test should be made, thus eliminating the possibility of examiner error. This recheck test may be done immediately or within a short period.

Prior to referral for medical examination and evaluation, the child should be tested to determine his threshold of hearing. This test determines the weakest intensity at which each of the frequencies can be heard. The usual frequencies for a threshold test include the full range of *250, 500, 1000, 2000, 3000, 4000, 6000* cps.

Many programs which use the 15 db level for the initial screening test use "failure to hear 20 db in any two tones or 30 db in one tone" as the criteria for referral to a physician. These criteria alone are not adequate. An interpretation of the results of the threshold test must be considered along with an interpretation of other case history data in order to decide on the need for further examination. The referral criteria must, of course, take cognizance of the available resources for more complete examinations. The criteria should be formulated with the advice of well informed medical and other professional groups in the local area. Only an otological evaluation can determine the condition of the ear, therefore, ***the referral criteria should be at least as sensitive as the screening criteria.***

The Conference on Identification Audiometry recommended that the criteria for failure at the threshold test be based on the frequencies: 1000, 2000, 4000 and 6000 cps. The recommended intensity criteria is failure to hear at 10 db at 1000, 2000 and 6000 and 20 db at 4000 cps.[23] In many States, the decision to refer to a physician or to an otologic clinic is made with the participation of an audiologist who may, in some instances, conduct additional tests.

Providing equipment

The following items should be considered before selecting the audiometers or other testing equipment:

1. Assess the audiometer's immediate and possible purposes. If the audiometer must be used for both the screening and the threshold testing phase, then an audiometer with a wide range of frequencies, equipped for bone conduction testing with masking noise, is desirable. If other clinical type audiometers are available to the program, then additional audiometers for screening purposes can be chosen on the basis of their more limited capabilities. If the audiometer is to be used for diagnostic purposes and in clinical situations, then the number and the kinds of accessory tests and equipment available are significant items for comparison among models of audiometers.

2. Determine the total costs involved. In addition to the original cost of the instrument, other costs must be considered: the cost of maintenance and recalibration, including the cost of shipping the instrument, and the cost involved in training the testing personnel.

3. Assess the testing time involved with the different kinds of audiometers. This factor will not vary as a function of different audiometers except in the case of the narrow range audiometer. The testing time lost due to repair and recalibration is an additional item to be considered.

4. In group audiometry, additional costs are involved in providing adequate testing space, better testing environments, and additional maintenance of the head phones.

5. Assess the ease of operation and the kind of abuse the equipment will receive. Weight and durability are factors in carrying the audiometer from place to place. The location and ease of operation of the dials and switches affect the operator's fatigue.

6. In order to assure minimum interference from environmental noise, quiet testing facilities are desirable. Purchase of the prefabricated soundproofed booths appear to be more satisfactory than attempting to redesign and soundproof a regular room. The present development and use of large aural cushions or noise shields into which the earphones are fitted may be an answer to some of the problems of noise.

Selection and training of personnel for testing operation

The testing of hearing may be performed in different communities by nurses, speech therapists, audiometric technicians (audiometrists), voluntary workers, or students. Considerations in deciding who is to conduct the testing operation include (1) making the most efficient use of manpower, and (2) insuring that the total hearing conservation program will be understood and accepted by parents, teachers and physicians.

Initial screening testing of hearing with the audiometer must be distinguished from other aspects of the hearing conservation program. It involves two job tasks: the administrative details and arrangements, and the actual performance of the audiometric test procedures.

The knowledge, ability and skill which are required for the task of organizing and developing the administrative relationships concerned with a hearing testing program may be possessed by a number of different kinds of professionally trained persons.

The second task, a time consuming one, involves the actual operation of the audiometer. The competencies needed are: (1) a desire to conduct such tests; (2) a warm personality to deal with children; (3) good hearing for the purpose of determining when the audi-

ometer is not operating properly; (4) an ability to learn the simple procedures involved in operating the instrument and recording the results; and (5) a willingness to adhere rigidly to the specified procedures and to maintain the confidentiality of the test results. These competencies can be met by voluntary workers who have received some special training. The competencies ***do not require professional training as a nurse, speech pathologist, audiologist, or other professional person.*** The time of professional persons can be used for other responsibilities in the hearing conservation program.

For the threshold testing stage prior to medical referral, a different level of competency is needed. The examiner must be able to exercise good judgment as to the kind of results expected under certain conditions. He must be skilled in testing children who do not respond readily. He must be able to conduct bone conduction audiometry. He must have the professional skill to elicit other evidence of the hearing status of the child in order to make a better recommendation regarding referral of the child to a physician. The decisions and judgments to be made require that the person have knowledge of, and understanding of, the different kinds of hearing impairment; knowledge of the principles involved in audition; ability to establish and maintain good working relationships with other professional personnel, such as physicians, psychologists and social workers; and knowledge of the resources and services available for children with hearing impairments.

Hearing testing programs for infants and preschool age children require different knowledges and skills.

The problems in developing a testing program for infant and preschool children require competency in community health organization. The public health nurse, for instance, with her experience in well child supervision, handicapped children's clinics, and home visitation has an important role in planning and carrying out this aspect of casefinding in a hearing conservation program. While the specific competencies needed for this kind of testing have not yet been well established by field experience, it seems clear that a thorough knowledge of growth and development is as important as a technical audiology background. The testing procedure requires that the auditory stimulus be presented in a controlled manner and that the auditory response be carefully observed. Skill, therefore, must be used in presenting the sounds; judgment, in noting the observable response; and knowledge, in interpreting these responses in light of the child's total behavioral growth and development.

DIAGNOSTIC AND TREATMENT SERVICES

The need for a comprehensive evaluation of hearing impairment seems self-evident yet not all children who have been identified as needing further attention receive it.

A comprehensive evaluation should include the following:

1. **Medical examination and appraisal, including both pediatric and otological evaluations.**
2. **Audiological evaluation of performance in, and capabilities for, functional hearing, speech and language.**
3. **Evaluation of the special needs for education, social service and rehabilitation.**

Medical evaluation

The objective of medical evaluation is to arrive at a medical diagnosis and a plan for medical care and treatment. For this purpose the child's total health must be considered. The program should guard against becoming "ear-oriented" rather than child-oriented.

Special otologic clinics and pediatric clinics supported by State and local health agencies should be developed in cooperation with interested local otologists, pediatricians, audiologists and educational specialists for the purpose of providing medical diagnostic services and for deciding the next steps. The nature and severity of some hearing impairments may necessitate multidisciplinary evaluations. Where such special clinics are not feasible as part of the program, other arrangements should be made for referrals for otologic and pediatric examinations.

Treatment of hearing impairment

Otologists state that the majority of hearing impairments in children could be reversed and/or modified to be less severe with early and adequate medical care. An adequate and effective hearing con-

servation program must include provisions for medical and surgical care when necessary.

Medical preventive measures are often common sense recommendations which start with health education about hygienic ear care. Public health nurses and school health nurses are key personnel in this aspect of the hearing conservation program.[24]

Preventive measures include the effective treatment of upper respiratory infections, of acute and chronic otitis media, and the removal of adenoid tissue which may be blocking the opening of the Eustachian tube.

The prevention and early treatment of such infections as measles, scarlet fever, and meningitis, contribute to the prevention of hearing impairments. Research into the causes of birth defects may lead eventually to ways of preventing those conditions which lead to hearing impairments.

For those individuals for whom a hearing problem already exists, surgical measures may be helpful. Middle ear surgery in which the ear drum membrane is restored (myringoplasty), or the middle ear structure is repaired (tympanoplasty), is being performed more frequently, because of recent refinements in surgical instrumentation and techniques. (Other procedures such as mobilization of the stapes footplate, stapedioplasty, and the fenestration operations, are significant in conserving hearing in the adult population with otosclerosis.)

A hearing conservation program can make contributions to the medical and surgical treatment by providing thorough and continuing interpretation of the value of early medical care. The program should provide opportunities for cooperative relationships between medical, audiological and educational personnel. In order to promote multidisciplinary contributions, special clinics can be conducted by the community's maternal and child health and crippled children's agencies.

Educational publications and the use of mass media to inform parents about hearing problems are an essential part of a hearing conservation program.

Audiologic evaluation

Audiologic evaluation has as its objective the thorough investigation of the child's potentials for communication. Special tests help in making a differential diagnosis between the different kinds of hearing impairments, and other oral language impairments. Without competent audiological evaluation, both children with hearing impairments and children whose communication disorders are not

connected with hearing may very well receive inappropriate or inadequate services. Children who do not have an "ear problem" but who have a cerebral dysfunction which results in a communication disorder of a verbal symbolic nature also may need the special skills available in an audiology center. The knowledges and skills in the field of audiology which contribute to social adequacy in communication are included in the following:

Selection of a hearing aid.

Auditory training.

Speech (lip) reading.

Speech training.

Counseling.

Selection of a hearing aid

Because a hearing conservation program must depend upon competent advice, the audiology center should meet high professional standards as should the audiology personnel.[25] If such a center is not available in an area, those responsible for the hearing conservation program should encourage and support its establishment.

Audiologists differ on the question of hearing aid selection. Some are specific about which aid should be purchased; others feel that the responsibility of an audiology center is to determine only whether a hearing aid is truly indicated.

The audiologist's recommendations are based on a comparison of the results of testing the hearing impaired person with the aid and without the aid. The results of testing with different aids may lead to a specific recommendation among those available for trial. Essentially, the tests for selecting a hearing aid determine how loud speech must be before it is heard (speech reception threshold), how much loudness can be comfortably accepted (tolerance), and how well speech can be understood (discrimiation).

A hearing aid can be selected for children by these same procedures used for adults providing the child can respond with language. For those who cannot, the judgment of the audiologist is based on personal observations of the child's reactions to sound. Continued parental reports are needed about the child's reactions to the aid if one is fitted.

An aid should be recommended for an infant only if a competent diagnosis establishes the child's need for amplification.

A person who acquires a hearing aid is suddenly introduced to an acoustic world for which he is unprepared. He will need a period of hearing aid training, including orientation to the aid as well as auditory training (see page 20).

Hearing aids are devices which can be broken, and whose function may deteriorate. A program should plan for: (1) the replacement or repair of breakable parts (cords, etc.), and (2) periodic reevaluation of the child's hearing performance with and without the hearing aid.

The provision of an aid is, it must be emphasized, only part of the total rehabilitation process. The child needs a thorough appraisal, physical, mental and emotional, and a planned habilitation program.

Hearing conservation programs which provide aids to those children eligible face a major problem concerned with the selection of the aids. Because there is no evidence to demonstrate that "cost determines value" or that more expensive aids will provide better hearing, the problem of determining which aids will be purchased, and what price will be paid, becomes a critical issue to both audiologists and administrators.

A difficult decision concerns which of the many hearing aids on the market will be approved for purchase. Approval could be given for purchase of any aid on the market which is recommended by an audiologist, or only for aids on an "approved list."

The concept of an approved list is appealing for if funds are to be expended wisely, some limitation on expenditures must be considered (Table 3, Appendix A). There is a wide range of prices and models. In actual practice, an audiology center cannot stock a great number of aids, nor would there be time to test each of many aids on a listener. Therefore, when an audiology center makes a recommendation for a specific aid, it is based upon the limited number of aids in stock at that center. Thus there is already one limitation even if approval were given to the purchase of *any* aid.

If a list of "approved aids" is desired, a difficult problem in making a comparative evaluation of the aids exists. At present, the Veteran's Administration attempts to evaluate and select aids for their own program. The procedure combines performance data, scored as to importance and cost data. The results are considered to apply to the specific purposes of the Veterans Administration and have not been made widely available to others.

To prepare such a list of approved aids necessitates selecting the criteria on which the aids can be judged. As a minimum these criteria should reflect the recommendations of local audiologists and otologists as to the predicted requirements and the known characteristics of the aids at that time. Such an approved list would need to

include a number of aids for different individual audiologic requirements. A choice of more than one manufacturer's aids and more than one model should be available. Price should be one of the criteria.

Regardless of how the aids are to be approved, the method of paying for the aid can vary. The basis for payment can be established as: (1) the listed price (retail), (2) a negotiated rate (discount), or (3) a bid rate.

Once a rate has been established, the purchasing agency must determine whether: (a) to make a full payment from its own funds, or (b) to seek partial payment from other sources including the family. In the latter case, a maximum payment may be established in which a specified amount is allowed against the cost of any recommended aid. Ideally, the amount of this maximum payment should equal the cost of a good quality, low-price hearing aid.

If a fee schedule is developed based on negotiated rates (bidding or otherwise), the agency then pays only one price no matter which vendor is involved.

Aids can be purchased by the individual bidding process providing: (1) a specific aid has been recommended, and (2) there are no exclusive dealerships for the recommended aid in the area which preclude bidding. Whether an aid should be purchased from a dealer near the user's home or whether any lowest bidder should be used is a moot question. This decision would have to be based on the individual circumstances which would include a consideration of the need of easily available service.

Whatever purchasing method is used, a child who needs a hearing aid should receive it just as a child who needs an orthopedic appliance is served. Provision should be made for special individual needs. Binaural hearing aids and those in eyeglass frames should be approved only upon special recommendation of an audiologist.

Auditory training

The purpose of auditory training is to enable a person to make better use of whatever hearing ability he has. The concept is broader than, but can include "hearing aid orientation." The person is taught with and without amplification, to hear acoustic differences in sounds and speech. He learns to detect differences in sounds and begins to respond to their meanings. Normally, he is taught first to detect gross acoustic differences and then finer acoustic distinctions. Various learning drills and life-situations are part of the motivational process.

Auditory training is a learning activity which must be provided at the time the child is ready. Normally this auditory learning begins in infancy: a planned program should begin as early as the

problem is recognized. Detection of a hearing loss prior to school attendance should lead to the planning of an auditory training program at home. *Also, the preschool hearing handicapped child needs special preschool training programs (including parent counseling), where he can be provided with special auditory training.* Usually this auditory training is carried on with amplification, through high fidelity amplifiers and high quality earphones. One or more children can listen to prerecorded or live speech. In some communities, special classes in public schools attempt to provide this learning experience for both preschool and school age children with severe hearing impairment. In most communities, the hard of hearing child is not provided for except at the school age. Clearly, the matter of enrollment should be in terms of the child's needs not in terms of a classification based on a pure tone audiogram.

Speech (lip) reading

Speech reading is a process of looking and listening. Meaning is gained from observing the speaker's facial movements, especially his mouth and lip actions. Clues, visually recognized, help to make distinctions between sounds which may have similar acoustic patterns, but which are formed differently. For one who has a severe hearing handicap, speech reading, aided by his limited residual hearing, can be his means of understanding.

Speech reading, like auditory training, should be an integral part of home training and preschool training programs for children whose hearing handicaps are found before school attendance. Special parent guidance programs should teach parents the principles involved so that they can carry on a home training program.

Speech training

A hearing impairment affects speech in different ways. Mild or moderate loss in sensitivity may result in defects of articulation; more severe losses in sensitivity may affect the normal development of both articulation and language. The child who does not hear well cannot respond appropriately and thus his learning of speech is delayed by his limited language experiences.

When the loss in hearing sensitivity is profound, voice quality is affected adversely.

A hearing impairment may be so severe, or of such a kind as to preclude any normal development of language. Auditory stimuli may be incorrectly transmitted, or encoded, or not perceived at all, with the result that bewilderment replaces understanding. A child

with a language disorder needs special training in addition to speech training.

The development of speech begins long before the school age. A hearing conservation program should not wait until school to provide the speech training. For speech training, as for auditory training and speech reading, it is necessary that competently trained persons direct the program. In actually carrying out the speech training, however, parents, other health workers who visit the home, child development specialists and teachers in the schools can function effectively.

Counseling

The child with a hearing handicap is often isolated from other people. Special consideration must be given to help him in his relationships, particularly in his adjustment to other children.

Both social casework and social groupwork service offered by various community agencies can be drawn upon for this purpose. Of particular importance is the help that needs to be given to the family. Their understanding and emotional acceptance of the child will help him to achieve maximum satisfaction as a person and as a member of society.

The development of early educational guidance and vocational guidance programs should be encouraged by those responsible for the hearing conservation program. The child with a hearing handicap needs a variety of counseling services at different stages in his development.

APPENDIX A

The material in this appendix appeared as a "Special Report on the Senate Antitrust Committee Hearings on the Prices of Hearing Aids" by Laszlo Stein in the July 1962 issue of *Asha*. It is reproduced with permission of the author and the American Speech and Hearing Association. The article is based on information presented at the hearings before the Subcommittee on Antitrust and Monopoly of the Committee of Judiciary, United States Senate, 87th Congress, Second Session, pursuant to S. Res. 258, April 18, 19, 24, 25 and May 16, 1962.

TABLE 1. DATA ON HEARING AID COMPANIES WITH NET TOTAL SALES OF ONE MILLION DOLLARS OR MORE—1960

Company	Dollar sales	Unit sales	Number of dealers	Dealer's average monthly unit sales
Audivox	$2,353,815	16,260	266	5.1
Beltone	7,323,200	54,267	208	21.7
Dahlberg	2,666,595	26,812	178	12.6
Dictograph	3,280,452	34,073	348	8.2
Maico	[2] 3,420,975	27,911	272	8.6
Otarion	2,106,279	14,937	172	7.2
Qualitone	[3] 2,369,256	33,127	386	7.2
Radioear	1,507,034	9,308	150	5.2
Sonotone	[1] 8,902,878	33,505	326	8.6
Telex	[4] 1,097,240	9,198	150	5.1
Zenith	9,610,091	67,917	1,858	2.8
Total	44,637,815	327,315	.....	.....

[1] Hearing Aids at retail prices. Parts, accessories and batteries at wholesale prices.
[2] For the year ending February 28, 1961.
[3] For the year ending April 30, 1961.
[4] For the year ending March 31, 1961. Includes $99,190 received for factory service and repairs.

TABLE 2. AVERAGE HEARING AID PRICE TO DEALERS, FROM MANUFACTURERS WITH DOLLAR SALES IN EXCESS OF ONE MILLION DOLLARS—1960 [1,2]

Company	Average price
Audivox	$94.20
Beltone	103.74
Dalhberg	N.F.
Dictograph	N.F.
Maico	96.15
Otarion	117.03
Qualitone	61.56
Radioear	136.42
Sonotone	[3] ——
Telex	91.16
Zenith	93.54

[1] Total net hearing aid dollar sales divided by total unit sales.
[2] See Table 1, footnotes 2–4.
[3] All Sonotone dealers are employees, not independent dealers.

TABLE 3. DATA ON HEARING AID COMPANIES WITH DOLLAR SALES IN EXCESS OF ONE MILLION DOLLARS AS OF AUGUST 14, 1961 [13]

Company	Least expensive monaural hearing aid			Most expensive monaural hearing aid		Total number [1] of models
	Suggested retail price	Type	Dealer mark-up (percent)	Suggested retail price	Type	
Audivox [4]	$225.00	B [7]	[3] 304	$345.00	EG [7]	[2] 12
Beltone [5]	281.75	B	160	349.00	EG	7
Dahlberg [6]	149.50	B	[8] 162	369.50	EG	9
Dictograph	[9] 99.50	B	137	349.50	EG	13
Maico	[10] 235.00	EG	183	[10] 345.00	B, EG	8
Otarion	99.50	B	83	341.00	EG	[2] 13
Qualitone	199.00	EG	186	339.00	EG	[2] 12
Radioear	208.00	B	170	315.00	EG	6
Sonotone	259.00	ITE	[11] —	315.00	EG	12
Telex	177.50	B	186	[12] 329.00	B, EG	8
Zenith	50.00	B	33	285.00	ITE	11

[1] Setting or adjustment variations or other slight differences, and binaural instruments are not counted as separate models. If they were, the number of models for all companies would be substantially increased.

[2] Since the Subcommittee received no response to question 15 of its questionnaire (identifying each hearing aid currently being sold) from Otarion, Qualitone and Audivox, this figure is derived from the most recent price list furnished by the Company.

[3] Based on "Net, Probable Dealer Cost," published by Audivox.

[4] Based on undated price sheets furnished to the Subcommittee by Audivox. Since only one set of price sheets was supplied, it is assumed that it was current as of August 14, 1961, the date of the Subcommittee's request letter.

[5] Based on "suggested" prices furnished by Beltone to State agencies, dated 2/1/62, and on 1961 Beltone manufacturer's prices.

[6] Based on published price sheets dated November 28, 1960, the most recent data furnished to the Subcommittee by Dahlberg.

[7] In the above table, "B" refers to body or conventional type hearing aid, "EG" to eyeglass type, "BTE" to behind-the-ear type, and "ITE" to in-the-ear type.

[8] Dahlberg furnished distributor prices, but no dealer prices for 1960. In 1958, the most recent year for which the Subcommittee has figures, distributor mark-ups on lower price instruments was 13–14%. Therefore, dealer cost is estimated as distributor cost plus a 14% mark-up.

[9] This hearing aid is one of four, lower price instruments marketed by Dictograph under the name "Monarch."

[10] Maico suggested retail prices on eyeglass hearing aids include frames. Price without frames is $10 less on both monaural and binaural fittings. However, Maico furnished dealer net prices only on fittings including frames.

[11] All Sonotone dealers are employees, not independent dealers.

[12] Telex did not furnish price data on its most recent eyeglass hearing aid model.

[13] Because all companies do not issue new prices and price changes concurrently, price figures used in the above table are current as of August 14, 1961, unless otherwise indicated. Eyeglass hearing aids do not include frames unless otherwise indicated.

TABLE 4. BATTERY SALES BY COMPANIES WITH DOLLAR SALES IN EXCESS OF ONE MILLION DOLLARS, PERCENT OF TOTAL SALES ESTIMATED BATTERY SALES BY DEALERS AND ESTIMATED DEALER PROFIT ON BATTERIES—1960

Company	Battery dollar sales by company	Percent of total dollar sales by company	Estimated dollar sales [4] by company's dealers	Estimated dolla profit [4] by company's dealers
Audivox	$719, 352	30.6	$1, 258, 866	$539, 51
Beltone	938, 398	12.8	1, 642, 197	703, 79
Dahlberg	[5] 132, 826	[5] 5.0	232, 446	99, 62
Dictograph	566, 886	17.3	992, 051	425, 16
Maico [1]	523, 100	15.3	915, 425	392, 32
Otarion	112, 523	5.3	196, 915	84, 392
Qualitone [2]	164, 566	6.9	287, 991	123, 42
Radioear	167, 069	11.1	292, 371	125, 302
Sonotone	525, 667	N.A.	919, 917	394, 25
Telex [3]	100, 929	9.2	176, 626	75, 697
Zenith	1, 916, 545	19.9	3, 353, 954	1, 437, 40
Total	5, 867, 861		10, 268, 759	4, 400, 898

[1] For the year ending February 28, 1961.
[2] For the year ending April 30, 1961.
[3] For the year ending March 31, 1961.
[4] Estimated on the basis of a 75% mark-up. This is believed to be the average dealer mark-up, *i.e.*, the amount by which the hearing aid manufacturer's price on batteries to the dealer is exceeded by the battery manufacturer's suggested list price.
[5] Estimated as total dollar purchases plus a 5% mark-up.

TABLE 5. DATA ON HEARING AID COMPANIES WITH DOLLAR SALES IN EXCESS OF ONE MILLION DOLLARS AS OF AUGUST 14, 1961[1]

Company	Eyeglass hearing aids					All model hearing aids	
	Least expensive monaural		Most expensive monaural	Most expensive binaural		Minimum mark-up percent	Maximum mark-up percent
	Suggested retail price	Dealer mark-up percent		Suggested retail price	Dealer mark-up percent		
Audivox [2]	$235.00	[3] 232	$345.00	$585.00	[3] 182	[3] 154	[3] 304
Beltone [4]	305.00	188	349.00	648.50	N.F.	160	225
Dahlberg [5]	329.50	[6] 217	369.50	709.00	[6] 195	[6] 162	[6] 262
Dictograph	[7] 299.50	215	349.50	[8] 687.25	[9] 134	134	215
Maico	[10] 235.00	183	[10] 345.00	[10] 657.50	176	135	187
Otarion	139.75	89	341.00	597.00	143	83	181
Qualitone	199.00	186	339.00	629.00	193	[15] 184	[15] 253
Radioear	225.00	163	315.00	610.00	132	112	170
Sonotone	285.00	[11] —	295.00	590.00	[11] —	[11] —	[11] —
Telex [12]	309.00	186	329.00	[13] 658.00	[13 14] 186	186	186
Zenith	275.00	141	275.00	550.00	152	33	152

[1] Because all companies do not issue new prices and price changes concurrently, price figures used in the above table are current as of August 14, 1961, unless otherwise indicated. Eyeglass hearing aids do not include frames unless otherwise indicated.

[2] Based on undated price sheets furnished to the Subcommittee by Audivox. Since only one set of price sheets was supplied, it is assumed that it was current as of August 14, 1961, the date of the Subcommittee's request letter.

[3] Based on "Net, Probable Dealer Cost," published by Audivox.

[4] Based on "suggested" prices furnished by Beltone to state agencies, dated 2–1–62, and on 1961 Beltone manufacturers' prices.

[5] Based on published price sheets dated November 28, 1960, the most recent data furnished to the Subcommittee by Dahlberg.

[6] Dahlberg furnished distributor prices, but no dealer prices for 1960. In 1958, the most recent year for which the Subcommittee has figures, distributor mark-ups on lower price instruments was 13–14%. Therefore, dealer cost is estimated as distributor cost plus a 14% mark-up. In 1958, distributor mark-ups on more expensive instruments ranged from 13 to 45%. Here dealer cost is estimated as distributor cost plus a 30% mark-up.

[7] This hearing aid is one of four lower price instruments marketed by Dictograph under the name "Monarch."

[8] No binaural prices were furnished to the Subcommittee by Dictograph. Price sheets furnished revealed that, at wholesale, active temples alone are typically five dollars less expensive than the complete, monaural price. At the same dealer's mark-up as Dictograph's two Acousticon models priced at $349.50, active temples alone would retail for about $337.75. Therefore, the binaural price has been estimated as the sum of these two figures, *i.e.*, $687.25.

[9] Dealer cost estimated at $294.00. See *supra*, footnote 8.

[10] Maico suggested retail prices on eyeglass hearing aids include frames. Price without frames is $10 less on both monaural and binaural fittings. However, Maico furnished dealer net prices only on fittings including frames.

[11] All Sonotone dealers are employees, not independent dealers.

[12] Telex did not furnish price data on its most recent eyeglass hearing aid model.

[13] No binaural prices were furnished to the Subcommittee by Telex. Therefore, the suggested retail price of a binaural fitting and its dealer cost is estimated as twice the monaural price.

[14] Dealer cost estimated at twice the monaural cost. See footnote 13, *supra*.

[15] Of the five (out of twelve) models on which Qualitone furnished dealer cost data.

TABLE 6. AVERAGE MANUFACTURING COST PER HEARING AID SOLD

Company	1951	1952	1953	1954	1955	1956
Audivox [10]	.....	.....	.....	.....	.....	.....
Beltone [1 2]	.....	.....	.....	.....	$35.37	$41.11
Dahlberg [1 4]	.....	.....	.....	.....	.....	31.67
Otarion [1 3 5]	.....	.....	.....	.....	72.74	72.53
Qualitone [1 6 7 8]	.....	.....	.....	.....	58.61	46.27
Radioear [1 9]	$64.55	$59.35	$82.67	$85.46	77.95	79.73
Zenith [1 3]	23.91	25.38	36.78	41.64	30.98	30.48

Company	1957	1958	1959	1960	1961
Audivox [10]	$41.36	$46.31	$46.35	$43.36	.....
Beltone [1 2]	41.21	49.68	51.16	54.68	.....
Dahlberg [1 4]	N.F.	38.85	40.07	52.57	.....
Otarion [1 3 5]	61.82	70.56	60.70	75.47	.....
Qualitone [1 6 7 8]	43.70	34.73	29.16	29.01	$31.86
Radioear [1 9]	N.A.	N.A.	[9] 78.27	[9] 77.29	.....
Zenith [1 3]	36.86	36.50	39.18	46.57	.....

[1] Basis: Average unit manufacturing costs (materials, labor and overhead) contained in this table, *infra*, were calculated on the basis of the following formula:

$$\text{Total Net Hearing Aid Manufacturing Costs} = \frac{\text{Total Net Hearing Aid Sales}}{\text{Total Net Sales (hearing aids, parts) (and accessories)}} \times \text{Total Net Cost of Sales (hearing aids, parts) (and accessories)}$$

In other words, it has been assumed that manufacturer's mark-up on parts and accessories is the same as its mark-up on hearing aids.

In the above table it was necessary to deduct battery sales from all Total Net Sales figures, and battery costs from all Total Net Cost of Sales figures. In so doing, it was assumed that purchases for a given year correspond to the sales for that year, *i.e.*, that there is no inventory of batteries, that battery inventories are constant, or that if they are not constant, variations are not significant.

In few instances, either battery purchase or battery sales figures were not furnished by the company. In such cases, they were, except in the case of Radioear, estimated on the assumption that the company sold batteries at a 5% mark-up over own cost. This mark-up is thought to be typical of the industry, at the wholesale level. Such estimates are noted where they occur.

While all companies were requested by the Subcommittee to furnish data sufficient to compute average unit manufacturing costs for hearing aids, only the following seven of the eleven companies with dollar sales in excess of one million dollars complied: Beltone, Zenith, Dahlberg, Otarion, Qualitone, Radioear, and Audivox.

Source: Data submitted by the above seven companies in response to Subcommittee request.

[2] The estimates are probably significantly higher than actual average unit manufacturing costs since Beltone's mark-up on parts and accessories is, in fact, lower than that on hearing aids.

[3] Battery costs have been estimated. See footnote 1.

[4] Battery sales were estimated. See No. 1 footnote above. Total Cost and Total Sales figures were furnished for the year ending April 30. Battery cost figures were furnished for the year ending December 31. Therefore, battery costs were estimated as the average of battery costs for the Total Cost year in question and for the preceding year.

[5] Total sales and costs figures furnished by Otarion included audiometer sales and costs. However, since Otarion stated in 1959 that 'hearing aid instruments and accessories accounted for over 99% of the company's (Otarion's) total volume for the years 1955–59,' it is believed that the impact of this inclusion on the above average cost figures is negligible. Insofar as it is nonnegligible, it tends to inflate the above average hearing aid unit cost figures.

[6] Battery sales were *not* estimated.

[7] Repair labor sales and costs were subtracted from Total Sales and Costs figures furnished by Qualitone. However, for the years 1959 and 1960, no repair labor cost figure was furnished. For those two years only, it was estimated at repair labor costs plus an 8% mark-up, the average mark-up for the 5 years for which figures were furnished to the Subcommittee.

[8] Total Sales and Costs figures furnished by Qualitone include audiometer sales and costs. Insofar as their impact on the total figures is nonnegligible they tend to inflate the above average hearing aid unit cost figures.

[9] Battery costs estimated. Estimate based on 9.5% mark-up, the average Radioear mark-up on batteries for the preceding four years for which figures are available.

[10] Basis: Total Cost of Hearing Aids and Audiometers sold, divided by total number of hearing aids sold. Insofar as Audivox sold audiometers during these years, the above estimates are excessive.

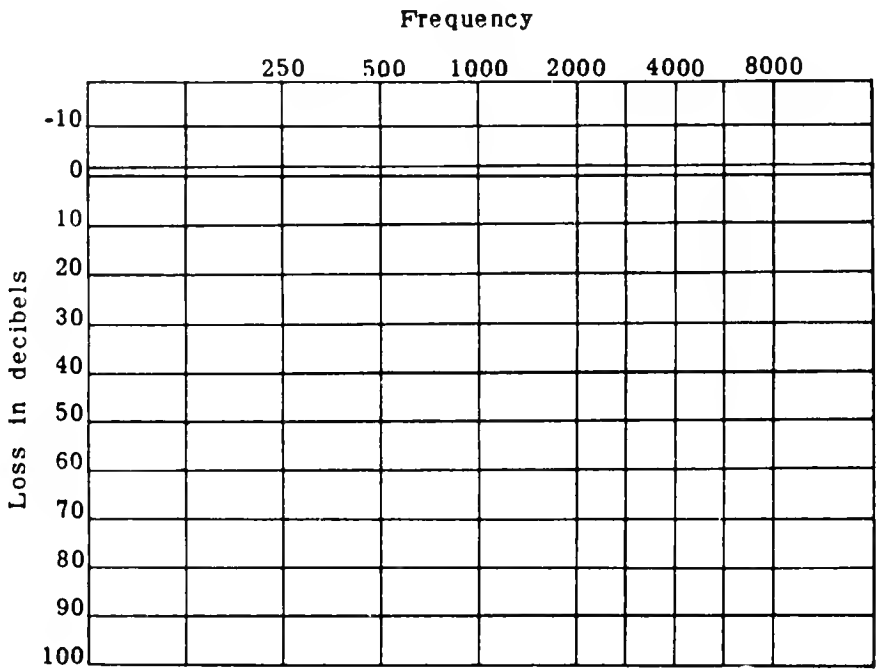
Hearing Conservation Program

HEARING TEST RECORD

Name _____ Age _____ Race _____ Sex _____ Parish _____
(Last Name) (First Name)

Parent or Guardian _____ Address _____

Name of School _____ City _____ Grade _____



Use These Symbols In Recording Audiogram:	Right Ear (in red)	Left Ear (in blue)
Air Conduction	○	×
Bone Conduction	>	<
Air Conduction With Masking	△	□
Bone Conduction With Masking	▶	◀

When signal is not heard at maximum intensity use arrow (↓) with appropriate symbol.

APPENDIX B

.....in cooperation with the

MICHIGAN DEPARTMENT OF HEALTH
Division of Maternal and Child Health
Hearing Conservation Section
Lansing 4, Michigan

☐ H file Case No.....

REPORT OF HEARING EVALUATION AND OTOLOGICAL EXAMINATION

Name..... (first) (initial) (last) Birth date..... (month) (day) (year) Grade..... Sex.....

Parent..... Address..... Post office.....

Name of School..... School system.....

Location of Board of Education Office..... (city or township only) Program: (.....) No..... (county, if district health dept.)

THRESHOLD SCREENING

Date..... Test No..... ☐ Technician

By..... ☐ Audiologist

Testing conditions: Quiet.....
Noisy (explain).....

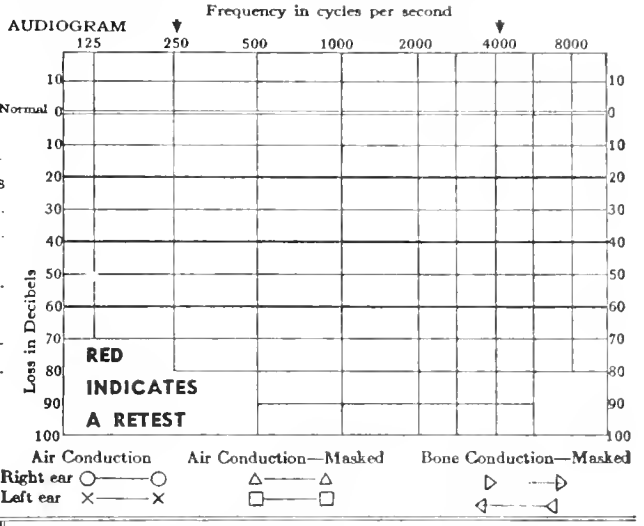
Response of child: Good or average.....
Poor (explain).....

History—child reports: Cold at present time? ☐ No ☐ Yes
Earache(s) ☐ No ☐ Yes R.....L..... When.....
Discharging ear(s) ☐ No ☐ Yes R.....L..... When.....
T&A ☐ No ☐ Yes ☐ Not known
Other (specify).....

Medical attention for ear condition by
Dr.....
When.....

Remarks:

(Continue on reverse side)



RECOMMENDATIONS

Public Health Recommendations

☐ Medical referral
☐ Recheck with audiometer periodically

Temporary Educational Suggestions

☐ Seating in front row near the teacher
☐ Seating near the front of the classroom and to one side so that the..... .....ear is toward the rest of the class
☐ Lip reading instruction if hearing loss is permanent
☐ Special room for hard of hearing if hearing loss is permanent
☐ Hearing aid evaluation if hearing loss is permanent

Audiologist.....

CLINICAL HEARING EVALUATION

Retests (on chart above): ..... (date)

A/C: Masked at.....db

B/C: Masked at..... .....db Lateralized to .....

	Right	Left	Both
Pure tone avg.			
Speech reception:			
Disc. PB-Max:			

Remarks:

Audiologist.....

OTOLOGICAL EXAMINATION (Use reverse side if necessary)

Examination

Diagnosis

Prognosis for hearing

Recommendations

Date..... Examining Otologist..... M.D.

H-400BCCD MEDICAL REFERRAL SET REV. 7-62 3M

(SHEET C) 11

LOCAL HEALTH DEPARTMENT COPY

See "Record of Medical Treatment Administered" on reverse side

Remarks (continued from reverse side)

RECORD OF MEDICAL TREATMENT ADMINISTERED

Treatment	Date	Physician	Treatment	Date	Physician
Adenoidectomy			Otitis media treated		
Secondary					
Allergy treatments			Politzerization		
Aspiration			Polyp removed		
Cerumen removed			Radiation treatment		
Cholesteatoma removed			Stapes mobilization		
Fenestration			Submucous resection		
Inflation			T & A (Tonsillectomy and Adenoidectomy)		
Mastoidectomy			Tonsillectomy		
Medication (describe)			Tympanoplasty		
			Other (describe)		
Myringotomy					

Nurse (signature) _____ Date _____

Remarks:

Conservation of Hearing Form

WASHINGTON STATE DEPARTMENT OF HEALTH
Division of Child Health Services
Conservation of Hearing Program
SMITH TOWER, SEATTLE 4, WASHINGTON

State File No. _____

_____
(Name of local health dept.)

Name _____ Sex _____ Birthdate _____ Color White _____ Non-White _____
(Last name) (First name)

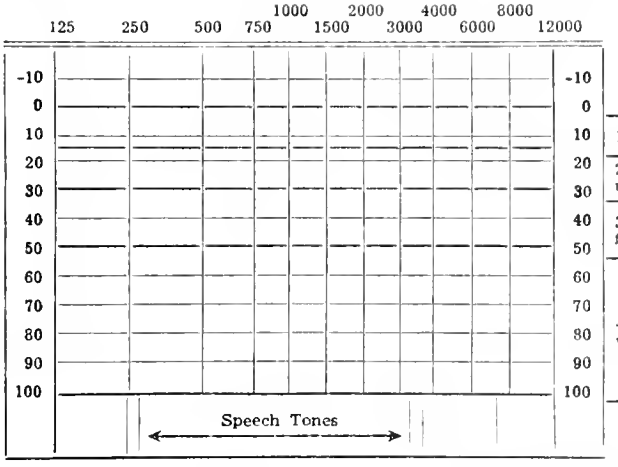
Parent or guardian _____ Address _____ City _____ Phone _____
(Full name)

Name of school _____ City _____ County _____

Grade _____ Scholastic rating: Satisfactory _____ Unsatisfactory _____

Technician's comments _____
(Environmental noise, cooperation of child, evidence of cold, etc.)

Audiogram made by _____ Date _____



AIR BONE

R. O. < (Use red pencil)

L. X. > (Use blue pencil)

Masking Used: Place ☐ around air or bone symbol

1. **Normal Hearing**
2. **Mild Hearing Loss** (No difficulty understanding spoken voice)
3. **Moderate Hearing Loss** (Some difficulty understanding spoken voice)
4. **Severe Hearing Loss** (Loss of serviceable hearing)

HISTORY

To be completed by the public health nurse before the otological examination. Where possible use date to answer the question positive; where negative use dash (—).

1. Family History, Prenatal and Birth

a. Hearing loss noted by parents _____
b. Family history of deafness: Yes _____ No _____
Relationship _____
c. Prenatal: Maternal rubella: Yes _____ No _____
RH factor: Parents compatible: Yes _____ No _____
Other _____
d. Birth: Spontaneous _____ Abnormal _____
(Specify)

2. Previous Treatment
(Give approximate date and specify)

a. Ears _____
b. Nose _____
c. Throat _____
d. Tonsils and/or adenoids removed:
Yes _____ (Date) _____ No _____

3. Childhood Diseases, Symptoms, Accidents (Give approximate date)

a. Scarlet Fever _____
b. Diphtheria _____
c. Measles _____
d. Mumps _____
e. Whooping Cough _____
f. Allergy _____
g. Chicken pox _____
h. Tonsilitis _____
i. Mastoiditis _____
j. Meningitis _____
k. Encephalitis _____
l. Earaches: R _____ L _____ When _____
m. Running Ears: R _____ L _____ When _____
n. Accident _____
(Fall, blow on head, etc.)
o. Undiagnosed High Fever _____
p. Colds: Occ. _____ Freq. _____
q. Mouth breathing _____
r. Head Noises _____
s. Defective speech or voice _____
t. Approx. age child began to talk _____

Is child under care of any other agency or program? _____
(Please explain)

Exposure to loud noise (gunshot, firecracker, etc.) _____ _____
(Approx. date) (Explain)

Nurse's Comments _____

_____ _____
(Signature of PHN) (Date)

Child's name _____
(First name small letters—LAST NAME LARGE CAPS)

S. F. No. 8227—10-60—10M. 64414.

OTOLOGICAL EXAMINATION

Degree of Involvement

*Use this code for all starred items

— no involvement
+ 25% involvement
++ 50% involvement
+++ 75% involvement
++++ 100% involvement

_____ (Child's name)

1. **Mouth and Throat**
   a. Teeth: Care indicated: Yes____ No____
   b. Tonsils: Not involved_____
   (Specify) Out_____
   Diseased_____
   Needing removal: Yes____ No____

2. Nasopharynx
   a. Examined by: Mirror_____
   (Check) Digital_____
   Nasopharyngoscope_____
   b. *Shows: Adenoid Tissue_____
   Lymphoid Tissue_____
   Inflammatory Changes_____
   Eustachian Tube
   Involvement—R._____ L._____
   d. Inflammatory _____
   e. Septum _____
   f. Allergy_____
   g. Other_____

3. *Nose
   a. Mucous Membranes: R._____ L._____
   b. Turbinates: R._____ L._____
   c. Discharge _____

4. **Sinus Transillumination**
   a. Frontal: Clear____ Cloudy____ Dark____
   b. Maxillary: Clear____ Cloudy____ Dark____

5. **Glands**
   a. Where_____
   b. *Degree_____

6. **External Ear**
   a. External Canal: Cerumen: *R._____ L._____
   Inflammation: *R._____ L._____
   Discharge: R. Yes____ No____
   L. Yes____ No____
   Secretory Otitis: R. Yes____ No____
   L. Yes____ No____
   Atresia: R._____ L._____

7. **Membrana Tympani**
   Perforation: R._____ L._____
   *Retraction: R._____ L._____
   Scar Tissue: R._____ L._____
   Inflammation: R._____ L._____
   Other: _____

8. **Suspected Mastoid Involvement (check)**
   R. Yes____ No____
   L. Yes____ No____

9. **Tuning Forks**
   Rinne: R. Positive____ Negative____
   L. Positive____ Negative____
   Weber: Lateralizes to R.____ L.____ Neither____

10. **Special Examination Recommended (check)**
    a. Bone Conduction Audiogram____
    b. X-ray of____
    c. Allergy____
    d. Pediatric____
    e. Psychological____
    f. Other_____
    (Specify)

11. **Diagnosis by Otologist**_____

12. **Treatment Recommended:** Yes____ No____ Type of treatment_____

13. **Prognosis for Better Hearing (check):** Good____ Fair____ Uncertain____ Poor____

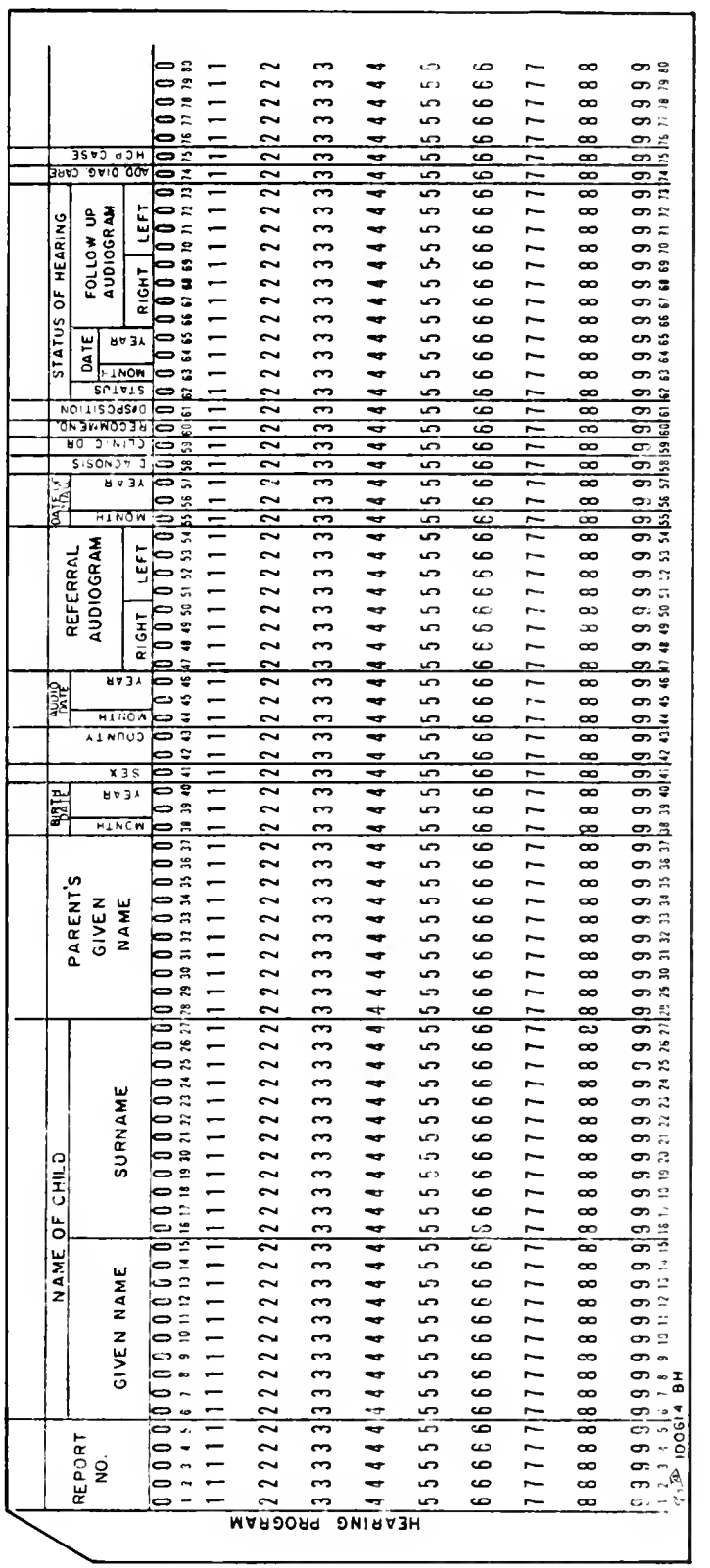
14. **Recommendations for Education and Rehabilitation**
    a. In Regular School (check): Lip Reading Instruction____
    Speech Therapy____
    Preferential Seating____
    Subject Matter Coaching____
    b. In School or Class for the Deaf: Yes____ No____
    c. Hearing Aid Consultation: Yes____ No____
    d. Other _____
    (Specify)

15. **General Summary**

Signature of Otologist_____ Date_____

Signature of Health Officer_____

APPENDIX C


HEARING PROGRAM
REPORT NO.
NAME OF CHILD
GIVEN NAME
SURNAME
PARENT'S GIVEN NAME
BIRTH DATE
MONTH
YEAR
SEX
COUNTY
AUDIO TAPE
REFERRAL AUDIOGRAM
RIGHT
LEFT
DATE OF TEST
ETIOLOGY
CLINIC OR
RECOMMEND.
DISPOSITION
STATUS
STATUS OF HEARING
DATE
FOLLOW UP AUDIOGRAM
ADD DIAG CARE
HCP CASE
100614 BH

Hearing conservation data can be processed on an IBM card such as the one illustrated from the Oregon Hearing Conservation Program, Department of Health.

The code for punching this card is given below. Note that both the results of the screening tests and the follow-up are recorded. The audiometric data are entered by averaging the intensities of three low frequencies and three high frequencies. For instance, for the right ear the average for the lower frequencies of 500, 1000, and 2000 is punched in columns 47 and 48. The average for the higher frequencies, 3000, 4000, and 6000 is punched in columns 49 and 50.

Columns 1–57: Identification number; child's name; parent's name; child's birthdate; sex; county; date of audiogram; results of referral audiogram; date of diagnosis.

Column 58, Diagnosis: 1. conductive; 2. sensory-neural; 3. mixed, 4. normal hearing; 5. non-organic loss, normal hearing; 6. suspected non-organic loss; 7. normal after removal of wax, inflation, etc.

Column 59, Clinic Doctor: 1. otologist in clinic; 2. resident in clinic; 3. non-clinic examination with otologist in office; 4. other—physician in office.

Column 60, Recommendations: 1. medical care; 2. nonmedical care; 3. repeat audiogram; 4. further medical evaluation; 5. further audiological evaluation; 6. hearing aid evaluation.

Column 61, Disposition: 1. care accomplished; 2. under care; 3. hearing aid; 4. non care.

Column 62, Hearing status: 1. normal; 2. improved; 3. same; 4. worse.

Column 63–65, Date.

Column 66–73, audiometric score, follow-up.

Column 74, additional diagnosis.

Column 75, Hearing Conservation program case number.

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